BELL TELEPHONE QUARTERLY

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A Medium of Suggestion and a Record of Progress

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Address all communications to

INFORMATION DEPARTMENT
AMERICAN TELEPHONE AND TELEGRAPH COMPANY
195 Broadway, New York

CONTRIBUTORS TO THIS ISSUE

BANCROFT GHERARDI

A brief biographical note regarding Mr. Gherardi appeared in the list of contributors in the *Bell Telephone Quarterly* for January, 1931.

KINGSLAND T. ROOD

Dartmouth College, B.A., 1918. After leaving the Army, entered the Long Lines Commercial Department, American Telephone and Telegraph Company, New York City, as a member of the Commercial Engineer's section, 1920. Transferred in 1921 to the staff of the Long Lines Magazine, which had just started publication; during the next eight years was successfully Assistant Editor, Associate Editor, Managing Editor and Editor. Also assisted in Long Lines publicity work. Publicity Manager, Long Lines Department, 1928–.

STANLEY A. HAVILAND

Cornell University, M.E., 1924. Entered Plant Department, New York Telephone Company, Manhattan Area, same year; later engaging in outside plant engineering, Bronx-Westchester Area. Since transferring in 1929 to American Telephone and Telegraph Company, has been engaged in underground conduit construction matters in the Department of Operation and Engineering.

LAURA M. SMITH

University of Chicago, B.S., 1914; Supervisor, Atlanta Public Schools, 1914–1918; Civilian Relief Worker, American Red Cross, France, 1918–1919; employed by Southern Bell Telephone and Telegraph Company, 1919; member of General Traffic Staff of that company, 1920–1923; for the past eight years, Assistant to Personnel Vice President, American Telephone and Telegraph Company.

ROBERT L. TOMBLEN

A brief biographical note regarding Mr. Tomblen appeared in the list of contributors in the *Bell Telephone Quarterly* for October, 1930.

HERBERT E. SHREEVE

A brief biographical note regarding Mr. Shreeve appeared in the list of contributors in the *Bell Telephone Quarterly* for October, 1930.

Progress Through Research

A paper read at Silver Anniversary Convention of Association of Life Insurance Presidents, December 11, 1931.

I GREATLY appreciate the honor of being asked to speak to the Association of Life Insurance Presidents at their Silver Anniversary Convention. I am not only appreciative of the honor but I am glad to have this opportunity to talk on the subject of progress through research.

I believe that science and its applications have been the major factor in changing the world during the last 150 years. I believe further that from such activities in the future changes will continue in the years to come. If this view is correct, my subject is one of major importance to all and especially to this group of men who direct the investment of such enormous sums of money each year.

From the time of Julius Caesar 2,000 years ago until that of George Washington 150 years ago there was but relatively little change in the lives which people of the civilized world led. People thought much as previous generations had thought. People lived much as previous generations had lived. They lived amidst desperate and unreasoning fears. The life of the average man was well described by Hamlet when he said, "To grunt and sweat under a weary life." Perhaps no better picture of this life has ever been painted than Millet's "Man with the Hoe," with which you are all familiar. A fundamental characteristic of this period, at least as to physical matters, was the general acceptance of the assertions of authority as to the ways of the physical world.

As a result of this general attitude of mind in regard to physical knowledge, an attitude of mind which was enforced

by various forms of autocratic authority, but few developments of a physical nature occurred that made any change in the life of man. At the moment I think of only four, the printing press, gun powder, the mariner's compass and the placing of keels on sailing vessels. Methods of production, of transportation and of communication remained practically unchanged. These methods were inadequate to produce sufficient of the necessities and conveniences of life to enable any but the favored few to have a standard of living above the lowest.

I am not saying that during this period there were no thinkers or searchers after truth in regard to matters concerning the physical world. There were a few, but in general the results of their working and searching were promptly lost. About 250 B.C. Aristarchus of Samos even before the time I am speaking of stated that the earth moved around the sun and undertook by methods which were correct in theory but limited by the crude instruments then available to measure the distance from the earth to the moon and to the sun. As a result of his work he was charged by the stoics of that day with impiety.

What he had done was promptly forgotten and his work was unknown to Copernicus who, in the early years of the 16th century, over 1,700 years later, stated again the correct relations between the earth and the moon and the sun. Perhaps fortunately for him he died just as his book was published. He perhaps may be taken as marking the start of the period when among the leaders of thought there began to be a definite rejection of authority as a basis of knowledge and an organized search for facts with regard to nature and for theories to coordinate these facts. The 16th century marked the fundamental work of Gallileo in Italy and of Newton in England, and from their time on a search for truth in the physical sciences was continuous and cumulative.

Probably Copernicus, Newton, Gallileo and the many other great minds who lived during their times and who followed

them and whose work greatly extended our knowledge of nature did not have particularly in mind the possibility that this knowledge would be of great utility to man. They were like the explorer who visits new places for the sake of learning things which have not been known before without necessarily any direct utilitarian objective. Their search for knowledge was for the sake of the knowledge itself and not for the use that could be made of it and their guiding principle was that we cannot derive our knowledge of nature by abstract reasoning but that we must examine the facts of nature itself and determine how things happen under various conditions. The vast fund of new information about physical matters which grew up as a result of this scientific research was bound to produce another type of research; that is, the search for ways to utilize the facts of nature for the benefit of mankind and so following the development of scientific research there grew up what may be called industrial research, research made possible by the new scientific knowledge and stimulated by the attitude of mind that things do not always have to be done as they had been done in the past.

Before the beginning of the 19th century traces of industrial research may be found here and there. During the 19th century it became clear to many leaders of thought and of industry that there were better ways of doing things than the way in which they had previously been done and that there were new things that could be done. So that today, in our colleges and universities and in many other laboratories, scientific research is being continuously prosecuted and this research furnishes the basic material for industrial research which is going on in numberless places throughout the civilized world. We need only look about us today to see in almost every field of human endeavor that has to do with physical matters the results of research. When George Washington wished to move from one place to another, like Julius Caesar he could walk, go on horseback or by stage coach and if he wished to travel by water he

could go in a row boat or in a sailing vessel. Their travel was slow and surrounded by numberless discomforts. How different the situation is today, with railroads, automobiles, flying machines and sea going vessels driven by powerful machinery, and, if one wishes to go under water, submarines.

In communication George Washington, like Julius Caesar, was subject to the limitations of transportation. It is true that such things as semaphores, heliographs and smoke signals were known and used in a very limited way but they really played no part in world communication. Today, the communication story is entirely different. Not only has the improvement of transportation vastly improved all of the older forms of communication, but entirely new ones, unknown and undreamed of when George Washington died, have been developed. This began about 1830 when in Albany a distinguished American scientist, Joseph Henry, demonstrated the principles of the electric telegraph, which principles were commercially applied by Morse in 1844 between Baltimore and Washington.

This invention immediately provided a means of communication independent of transportation not subject to its limitations and annihilated distance for written messages between points to which the system was extended. Still, however, there was one serious limitation to communication. When two people are near at hand their natural mode of communication is by the spoken word when, as is usually the case, no permanent record is desired. In 1876 Bell, by the invention of the telephone, removed this limitation and made it possible for two people to carry on a conversation even when separated by distances beyond those to which the human voice could carry. Out of the work of these men and by the efforts of a host of others who have followed them there was developed the electrical communication system of today which we all use in our business and social lives and which, so far as communication is concerned, brings all parts of the civilized world closer together

than were two counties in the same state in the life of George Washington.

Time does not permit more than a mention of a few of the many other fields in which revolutionary progress has been made—in the field of power, the steam engine, oil engine, gasoline engine, gas engine, in the chemical field, in the electrical motor and generator field and in many others to which research has been intensively applied.

While volumes would be insufficient to describe the research, the development work and the inventions which have produced the results of today in any one of the fields which I have mentioned, perhaps it will not be out of place for me to describe briefly one item of research which has contributed so much to the improvement and extension of the telephone system during the last 15 years.

Up to about 1910 the Bell System was so fully occupied in developing and extending its local and shorter-haul toll services that the question of transcontinental telephone service could not be a pressing one. About that year, however, it became clear to us that the time had come to seek for a solution to this problem, not that we had experienced any commercial demand for such service, but that we believed there would be a substantial use of the service if it were made available. We therefore decided to undertake the investigation. The first question which had to be settled was along what general lines the solution should be sought. Obviously the problem was one which could be approached in several different ways. We might undertake to develop a more powerful transmitter, or a more sensitive receiver, or a more efficient telephone line, or to develop a satisfactory and reliable telephone repeater, which is a piece of apparatus inserted in the line at more or less frequent intervals, by means of which the telephone current is magnified without changing any of its other characteristics.

Each of these methods of approach involved the exploration of territory at that time unknown or but dimly known. The

problem was like the location of a satisfactory pass through an extensive mountain range which had never been charted. It is not clear even where to start. Theoretically, of course, it would have been possible to have started research simultaneously on all four of these approaches. Practically, however, it was desirable to avoid this method if it could be done, because not only is such research expensive, but there were only a limited number of men available with the proper training and experience. Therefore, if at the start it was practicable to determine the correct general approach, much time and effort would be saved; and if the proper general approach was chosen, the result would be obtained more quickly than if the research efforts were scattered.

The various possible solutions were therefore carefully reviewed, and it was our judgment that in the light of such knowledge as we had, the solution to the transcontinental telephone problem lay in the direction of the development of a satisfactory telephone repeater. The problem was therefore intensively attacked from this point of view. Today, the answer to the proper method of approach may seem obvious, but that it was not so at the time our research was started is indicated by the fact that in Europe the solution of the problem of telephony over great distances was believed by many to lie along the lines of a more powerful transmitter, and much work was done there to develop such instruments. These have contributed as far as I know nothing to the extension of telephone service.

The solution of the transcontinental telephone problem was not a simple one. It did not alone involve the mere development of a device (the telephone repeater) to be placed here and there in the line. In addition to the development of such a device, the problem involved the development of methods by which this device could be connected in the line and would do its work on a two-way conversation; it involved the adaptation of the lines themselves to telephone repeater op-

eration; it involved modifications in maintenance and operating methods so that telephone repeaters could be successfully used. Each of these was in itself a formidable problem, but all were successfully solved, so that in September, 1914, Mr. Theodore N. Vail—then President of the American Telephone and Telegraph Company—had the satisfaction of speaking the first words that were heard across the Continent. This statement is literally true, because, having satisfied ourselves by experimental work on shorter lines that the system we had developed would operate satisfactorily, the line between New York and San Francisco was never connected through until Mr. Vail's first conversation.

The successful prosecution of a research problem such as this is not the work of any one individual. Hundreds of scientists and engineers contributed in an essential manner to the result, and many prior advances in the art were incorporated in the new devices and methods. Research is essentially cumulative in character. It builds upon the work of others not only within but outside of the organization.

In research work, as in other lines of endeavor, one thing often gives rise to another. Out of the solution of the transcontinental telephone problem, grew many other possibilities. It gave us the means of working long telephone cables, so that today wires in storm-proof telephone cables give service over distances of more than 1,500 miles. The present radio telephone art, including broadcasting, rests upon the developments made for and first used in the transcontinental telephone line. The whole of the talking movie art rests upon these developments, and but for their success a transatlantic telephone cable now within the range of practical engineering would still be a dream.

Research has had an important influence upon the organization of many industries. In the olden days, industry or business was essentially a matter of routines. Year by year, and generation by generation, the business was done in the

same general way; and except for a few people at the top of the organization making decisions, the carrying on of the business was practically the executing of established routines. Today, however, in many businesses and industries, a new branch of the organization has grown up. This branch is not concerned with the day-by-day operations of the business; its problems have to do with new devices, new methods, and with new modes of operation. From the beginning of the telephone industry, the chief executives of the Bell System have been strong in their support of this work. Mr. Walter S. Gifford, now President, is one of its keenest advocates.

Research is often thought of as an activity which is carried on in laboratories. Much research *is* carried on in laboratories, but in many cases the subject matter of research is of such a character that it does not lend itself to laboratory treatment. In this connection, I need only mention such research as is primarily statistical in character, research on social questions, and research on business methods.

At this point, two questions may be asked: "Shall we continue to have further important developments in the future?" and "What of it all anyway?"

To the first question, the answer is I believe easy; it is "yes." We have not exhausted the secrets of nature, and we have not ended the opportunities to apply, to the uses of mankind, even those that we do know. If we were to listen to any group of research men talking to one another, we would find that their conversation is not so much about what they have done as about what they are doing and what they are going to do, about things that are not today available, but which they confidently expect will be in the months or the years to come. Their confidence generally rests on a firm basis.

In the Communication field there has been something new offered to the public within the last thirty days. You have perhaps read a little about it in the newspapers. It is known as "switched teletypewriter service." For some time, tele-

typewriter machines have been in use connected with private lines. By the use of these machines and the private lines, it has been possible to send instantaneously written communications between the machines connected at the ends of the line. By a combination of these machines with the telephone switching art, and suitable adaptations of both the machines and the switchboards, a service has been offered to the public by which a connection may be established between any machine in the System and any other machine, and written messages may then be interchanged in the same way as oral messages are now exchanged over the telephone system. This places the written communication art on the same direct and instantaneous basis as is the telephone art of today.

I cite this merely as an illustration of a thing which was not done a month ago, which is being done today, and which in a few years will no doubt be a commonplace in our day-by-day life.

To the second question—"What of it all, anyway?"—the answer is not so simple, but I believe it is one of encouragement. It seems to me that one of the fundamental troubles in the world prior to the 19th century was that the known methods of production were not capable of producing enough to sustain the peoples of the world at any reasonable standard of living; in other words, that the combined efforts of practically everyone were not sufficient to produce results which would, even when judged by low standards, adequately house, feed and clothe everyone. I am not speaking of any question having to do with the inequalities of distribution, but am speaking of the total amount of production. Today, as a result of scientific progress and of its practical applications through research, this is no longer true. It is possible, by known methods, to produce enough in civilized countries to house, clothe and feed the population at high standards compared with any that formerly existed in the world, and to have enough left over so that the young may devote time to education, so that all may

be provided with books which they have learned to read and with other forms of amusement, and so that all may have leisure time for such uses as they wish to make of it.

Our problem today does not appear to be an inability to produce enough; rather, it has to do with how to utilize our present production capacity. It is not the problem of want, it is the problem of plenty. Such problems are not primarily for the engineer, the scientist, or the inventor; they are for those who deal with social, economic, political and financial questions; they are problems concerning human relationships.

The question has sometimes been raised as to whether perhaps some of our difficulties at the present time do not arise from the fact that while in the fields of the physical sciences we have abandoned the old methods of authority and tradition and made rapid advances as the result of a different approach, may it not be that authority and tradition still too much limit the development of social, political, economic and financial relationships. Upon this question, I do not feel competent even to suggest an answer. As bearing upon the answer to this question, however, I might point out that science is impersonal; that scientific research will aid in satisfying the desires of the peoples of the world, however such desires may be crystallized in the minds of the leaders. Science can give us higher standards of living as we may define them; it can give us more leisure for all of us to use or misuse as we may elect; it can give us more comfortable and convenient ways of living and carrying on human relationships; it can give us more effective ways of killing and maiming one another in devastating wars; it can aid in attaining whatever may be the objectives of those who are leading the world. Those who are prosecuting research in scientific and industrial fields and are applying the results do not determine their own objectives; the broad objectives are determined for them by others.

What special relation has research to the Life Insurance Presidents? What do you wish to know about a "risk" be-

fore you accept him? How about the acceptance of the risk of investing in or lending money to a business or industry? When a life insurance company is considering an applicant for life insurance, there are certain things which it would like to know about the applicant. Among these are his past history as to health and disease, and his present health. In addition, it wishes to know certain facts which will give some indication of his expectancy of future life, his habits, his home conditions, and other factors. The life insurance people know that one man is a good risk, and another a poor one, although as far as age, health and previous medical history they are similar. Is not the same true of any business? Does not the future health of a business depend not only upon what it has done and what it is doing today but what it is planning to do to meet the future? What is its vision for the future and what plans is it making to adapt itself to that vision? We all know that the general conditions and the surroundings under which business will be done will change; the habits of the people will change; their tastes and desires will change. Will the business in question change and adapt itself to these new conditions? Will it be progressive? Will it do its part in the creating of new conditions under which it can survive? Will it improve its product, improve its methods, develop new products, so that it will not only be among the leaders in its own field; but what is perhaps equally important, will it be able to hold its own in the competition for the customer's dollar in which every industry is competing with every other industry?

More and more as time goes on the answer to these questions will, I believe, depend upon the intelligence and vigor with which research is carried on and the intelligence with which the general management of the business or industry directs this research along the proper lines.

As with peoples, so with industry—"Where there is no vision the people perish."

BANCROFT GHERARDI.

Five Years of Overseas Telephone Service

FIVE years ago this month, the speech bridge with which Bell System scientists and engineers had succeeded in spanning the North Atlantic, was formally dedicated to public service by Mr. Walter S. Gifford, President of the American Telephone and Telegraph Company. On that opening day of January 7, 1927, the territory served by the transatlantic telephone channel was limited to the metropolitan districts of New York and London, embracing some 2,500,000 telephones.

Since then the telephone horizon has been constantly widened. Today it includes 32,829,000 telephones, or about 92 per cent of those in service throughout the world. The area thus served includes most of North America, much of South America, all of Great Britain and Northern Ireland, practically all of Europe from Brittany to the Black Sea, Australia, and a city in Africa. It includes, moreover, the islands of Java and Sumatra in the East Indies, Sicily, the Canary Islands, Bermuda and the Hawaiian archipelago. Seven large passenger liners, while at sea, maintain telephone contact with this great network through the ship-to-shore service. And the limit has by no means been reached.

As the service extensions have followed one another, the volume of messages has steadily gained. Daily transatlantic messages during 1927, the first year of the service, averaged seven. Each succeeding year has witnessed an increase, until during a record week last summer conversations between the United States and Europe averaged more than 100 a day. Total transatlantic messages for the year 1931 show an increase of 21 per cent over the total for 1930.

With these facts in mind, several questions naturally arise. Who uses the transatlantic service? What is it used for?

Has experience proven Mr. Gifford's prediction to Sir Evelyn Murray, Secretary of the General Post Office of Great Britain, during the ceremonies inaugurating the service five years ago, that "it will certainly facilitate business; it will be a social convenience and comfort; and through the closer bond which it establishes it will promote better understanding and strengthen the ties of friendship"?

The answers to these questions can be gleaned from the daily press. For ever since the service was established, its use has been chronicled as news, and the part it has played on important occasions or for important purposes has been widely commented upon. It is from such comments and news accounts, as well as from personal reports of patrons, that the material that follows has been compiled.

Financial

Almost from the day transatlantic telephone service was opened for public use, banks, brokerage houses and financiers have turned to the service as an instant, effective means of communicating between the money centers of Europe and America. A bank talks with its European representative to negotiate certain credits. A brokerage house keeps in close touch with political developments in a foreign capital. An American financier travelling abroad holds daily conferences with his brokers in New York. Almost every ripple that disturbs the financial world is faithfully reproduced in the ebb and flow of overseas telephone service, as the news of the day reveals.

When the "bull market" toppled from its peak in 1929 the transatlantic traffic for the next two or three days jumped to a record. During the period when the debt negotiations were in progress last summer, the interest of American financiers in Germany's economic fate was expressed in the largest week of transatlantic usage up to that time.

Again, when Great Britain announced her abandonment of

the gold standard last September, the announcement was followed by the establishment of a new message record for a single business day, when 162 transatlantic conversations took place on September 21.

The announcement last August that French and American bankers had combined in offering a credit to the British Treasury of four hundred million dollars included the statement that the negotiations had been completed largely by transatlantic telephone in the short time of 36 hours.

Going back to 1929 we find news items to the effect that a well known promoter, while travelling abroad, used the telephone daily during a period of intense activity in the stock market to keep in close touch with the situation. His calls were not only numerous but of unusual length. Press reports of the time estimated his expenditure of $25,000 during a single week on telephone conversations with his New York brokers. The reports added that he talked every day to each of a dozen brokers on one call, and that such calls sometimes lasted as long as an hour and a half.

Another important financial figure is said to have talked from the Savoy Hotel in London to New York in a 97 minute conversation.

Many similar reports might be cited, if necessary, to show how men of large affairs have adopted as one of their valued business tools a communications service that was a spectacular accomplishment only five years ago.

The Press

The establishment of overseas service came as a boon to the Press. Many a harassed editor has thankfully reached for his telephone and talked directly to someone on the scene of a news happening 3,000, 5,000, even 10,000 miles away, thereby confirming details, getting direct impressions of eye witnesses, and valuable bits of local color with which to embellish the story he may have received by routine channels. Frequently

the editor has been able to talk directly with one of the principals of such a happening and obtain an exclusive interview, through a transatlantic telephone conversation.

When some terrible tragedy occurs, the transatlantic telephone channel is sure to be used by editors in other lands seeking details for their readers. One instance was when the Cleveland hospital explosion horrified the civilized world two years ago. Interest abroad in the event was so intense that several English newspapers telephoned for last-minute information. The London Daily Mail queried the Cleveland News for nearly 25 minutes about the disaster.

Happier episodes of life, too, are often the themes of transatlantic newspaper reporting. When well-known persons, for example, are suspected of making nuptial plans, what better way is there of changing rumor into fact than by inquiring directly of the principals, even though they might be some thousands of miles away? That was the conclusion of a London editor last October when he called a well-known American actress and confirmed the rumor of her engagement to the younger son of a British Peer. Another London newspaper talked directly with the American woman tennis champion for the same purpose, and with a similar result.

Among the interesting interviews secured by the Press over the transatlantic telephone was one last September in which one of President Hoover's secretaries was asked by a European newspaper to confirm or deny a report that the President was considering calling a World Trade Conference. A New York evening paper interviewed Mayor Walker while the latter was abroad, concerning aspects of a city investigation then in progress. Following a receipt by Scotland Yard, last August, of photographs of a notorious criminal, a London evening paper interviewed the Police Commissioner of New York regarding the man and his exploits. Many other transatlantic calls to New York's police commissioner have testified to foreign interest in crime and criminals as well as to the usefulness of the

telephone channel that spans the Atlantic. That this channel can play a prominent part in the detection or prevention of crime is of course one aspect of its unique value as a means of international communication.

One piece of transatlantic newspaper reporting deserves more than a brief mention because of its resourcefulness and dramatic character. It has to do with the first arrival of the dirigible, *Graf Zeppelin,* in this country in October, 1928.

Sensing the news value of the event, a German news gathering organization arranged for one of its reporters to make the trip in the *Graf Zeppelin.* He was among the first passengers to disembark at Lakehurst, where he was met by an American representative of the news agency. The American several days previously had hired a room in a roadside refreshment stand, in which the telephone company had installed a telephone for him. He had then filed a call to Berlin to be put through on the airship's arrival.

Followed by the German visitor, he hurried to the stand. Meanwhile, learning from the din of whistles, horns and cheers that the dirigible was in sight, the Lakehurst central office force had started work completing the call to Germany. Within a few minutes the story of the eventful trip was being dictated to Berlin, where five stenographers, working in relays, took it down in short-hand during a forty minute call.

Government Officials

A roster of Government officials who have talked on the overseas telephone within the past five years would include several kings and presidents, prime ministers, high officials of various governmental departments, secretaries and under-secretaries in abundance, according to newspaper reports. It is interesting to recall that many government heads took part in the ceremonies extending overseas service to new countries. One of these occasions, on October 13, 1928, when President Coolidge conversed with King Alphonso of Spain, marked the

first time in history when a President of the United States has spoken with a ruling European Monarch by telephone.

When the overseas service was inaugurated between the United States and Austria, in November, 1928, the Secretary of State, Frank B. Kellogg, in Washington, exchanged greetings with Dr. Ignatz Seipel, Chancellor of Austria in Vienna. During the same month Secretary Kellogg took part in ceremonies extending overseas service to Hungary and Czechoslovakia. From Budapest, Count Stephen Bethlen, Premier of Hungary, addressed him while Dr. Eduard Benes, Foreign Minister in Prague, replied to Secretary Kellogg on behalf of Czechoslovakia.

While visiting in the United States, H. R. H. Don Alphonso D'Orleans, first cousin of the Spanish king, his wife and his son, talked from New York with King Alphonso in the Royal Palace at Madrid early in 1929. S. Parker Gilbert, Agent General of Reparations, about the same time, while in Washington to confer with heads of the State Department, talked with his Paris representative concerning the personnel of the Committee of American Experts for the forthcoming Reparations Conference.

When King George V of England made his famous address opening the Naval Arms Conference at London, on January 21, 1930, he spoke into a gold and silver microphone before his great gold chair in the royal gallery of the British House of Lords. His message was estimated to have reached the ears of a hundred million persons listening at radio sets in all parts of the world. A total of 121 radio stations broadcast His Majesty's words in the United States after they had been brought to this country over the transatlantic telephone channels, as well as by transmission through a British experimental short wave channel at Chelmsford. Americans had to rise early to hear the broadcast which began shortly after 6 A.M., New York time, and that same early hour was responsible for a great deal of delicate work on the part of Bell System tech-

nical men who were forced to shift frequently from long wave to short wave and back to long wave again.

In November, 1930, King George again spoke to the world at large through an extensive broadcasting hook-up when he opened from London the India Round Table Conference. The Columbia Broadcasting System received his words via the transatlantic telephone channel, as well as those of Premier MacDonald and the Indian representatives who spoke following His Majesty.

The voice of President Hoover has frequently been borne overseas by the Bell System's radio telephone facilities. Three years ago this month, he greeted the King and Queen of the Belgians meeting with governmental dignitaries in Brussels. When telephone service was established between the United States and South America, Mr. Hoover made the ceremonies notable by speaking with the presidents of Uruguay and Chile, seated in their respective capitals, and a day or so later he talked over the new channel with the president of Argentina.

Since that time Mr. Hoover and Secretary of State Stimson have employed the overseas telephone so often to reach U. S. officials abroad and the heads of European governments that, in the words of various newspaper editorials, they have inaugurated a new departure in diplomatic usage. In fact Mr. Stimson last Fall asked for a permanent installation in his office of several "head sets" so that members of his staff might at times listen in to his overseas conversations and make observations and notes as needed.

Last March the late Senator Morrow in London gave Mr. Stimson details concerning the proposed Naval Agreement between France and Italy in a 25 minute conversation.

While Mr. Andrew Mellon, Secretary of the Treasury, was in Europe in June last, he talked frequently with Mr. Hoover regarding the progress of the Franco-American debt moratorium negotiations. "At least twice the telephone operator at the American Embassy here with unaccustomed drama in her

voice" says a press dispatch from Paris, "has announced 'The White House calling' and, in between the Presidential talks, Secretary of State Stimson and others in the Department of State have been in telephonic consultation." Secretary of State Stimson joined Mr. Mellon in Europe and while there kept in touch with Washington by overseas telephone.

As a new British Cabinet was being formed with Ramsay MacDonald, British Premier, heading a Coalition Government last August, it was announced that President Hoover had talked with Mr. MacDonald across the Atlantic.

Last October, when Premier Laval of France was preparing to come to America to talk with President Hoover regarding the problem of Inter-Governmental debts, Secretary Stimson talked with the American Ambassador in Paris, regarding the proposed subjects of the conversations. Mr. Stimson also talked to Mr. Prentiss Gilbert, American Consul General at Geneva, regarding the latter's presence at the meetings of the League of Nations Council.

When Premier Laval arrived in the United States last Fall he used the transatlantic telephone almost every day of his visit in America to talk with members of his Ministry in Paris. Shortly after M. Laval arrived, Count Dino Grandi, Foreign Minister of Italy, and his wife also reached these shores for a visit. Both used the overseas service to talk to their homeland, the Count to report to Premier Mussolini, and the Countess to speak to her children who had been left at home.

Even more recently Winston Churchill, British statesman, while in New York, met with an unfortunate automobile accident. As soon as he recovered sufficiently from his injuries he made half a dozen transatlantic calls to friends and relatives in England to reassure them.

Business Uses

That the transatlantic telephone has proven itself a valuable ally to trade and commerce is already well established.

In the early days of the service the Studebaker Corporation was reported to have made a sale of a quantity of its automobiles to an importer in Germany, carrying on negotiations through the transatlantic telephone channel. The General Motors Export Corporation has likewise used the service widely for administrative and sales purposes. Its American headquarters at various times has talked to nearly every one of its units in Europe and South America, and has even conversed with its representatives in Adelaide, Australia. And speaking of automobiles, an American manufacturer of auto horns in Jackson, Mich., some time ago was delivering a sales talk to his prospect in London. To convince the customer of the quality of his product, the Michigan business man brought one of the horns to the telephone and honked it several times as an actual demonstration of what his horn could do.

Up to the minute style news has been obtained from Paris on numerous occasions by American merchants who wished to offer their customers the latest creations from France. On one such occasion 100 buyers were gathered in the showrooms of a New York importing firm while the head of the company sat at a telephone and talked with his son in Paris on fashion's modes of the moment.

Learning of a Glasgow merchant anxious to obtain at once a consignment of high grade flour, the salesman of a Toronto milling company talked by telephone with the dealer and sold him the flour for immediate delivery in Glasgow. A long distance telephone call to the company's mills at Port Colborne, Canada, followed, ordering the rush loading of the flour. Next morning the freighter passed Toronto outward bound for Glasgow, with 23,000 bags of Canadian flour in her hold. Another Toronto milling company executive called his Oslo, Norway, representative and settled a misunderstanding regarding freight rates. In speaking of the occurrence the export manager of the milling company remarked, " We have often spoken

to business firms in England but this is the first time we have had occasion to speak to Norway."

Even real estate has changed hands through negotiations conducted by overseas telephone. One such call effected the sale of large and valuable property in New York City. The American real estate broker called the owner of the property at his home in Dresden, Germany. Negotiations had been begun through other means of communication, but time pressed and quick action was necessary. The talk lasted a little more than five minutes and the property, including 12 stores, was disposed of.

A buyer for a large New York firm who has never been out of the United States is a frequent user of the service. Sometimes he talks to half a dozen countries in a single day, buying men's apparel in London, women's clothing in Paris, textiles in Berlin and other varieties of merchandise elsewhere, all the way from Stockholm to the Mediterranean. This man began his career in a small way through buying by telephone in San Francisco, Portland, Ore., and Western Canada.

Precious stones of considerable value have changed ownership after negotiations have been completed by telephone calls across the Atlantic. A New York jewelry firm found that a price increase in rough diamonds was to become effective in the London market almost immediately. With but a few hours leeway a telephone call to a London syndicate enabled the American firm to take advantage of an option at the old price.

Among some of the odd trades effected through the voice channels to Europe was the sale of a blue ribbon wirehaired fox terrier whose owner in Lancashire, England, telephoned to the prospective buyer in Worcester, Mass. A Philadelphia book collector successfully bid for a rare book at an auction in London without leaving his Quaker City office. A call to Europe from Tulsa, Okla., sold 3,000,000 gallons of gasoline. A motor boat company in Algonac, Mich., sold 100 boats valued

at approximately $500,000 in London in a few minutes talk via the wire and radio voice link.

And thus is borne out Mr. Gifford's prophesy that "it will certainly facilitate business."

Professional

Professional men and women in all fields of endeavor have learned that telephone service to Europe can be used to good advantage. Doctors, lawyers, preachers, architects and representatives of other professions have held consultations, delivered opinions and obtained needed information by timely use of the wire and ether voice channels. Stars of the stage and the screen have turned to it on many occasions, or have been called up by admirers a matter of 6,000 miles distant.

An American traveling in France a year or so ago was suddenly taken ill. He put in a call to his physician, in New Orleans. When the latter answered the telephone, the patient described his symptoms. The doctor diagnosed the case and gave a verbal prescription.

Two years ago a law suit involving $1,000,000 was settled in part by a fifteen minute conversation between London and New York. The suit involved contracts made by the British fuel administrator during the war. The attorney for the American plaintiff in his call persuaded the defendant to pay approximately $225,000, and stated later that he expected to adjust the entire claim by telephone.

When Sir Joseph Duveen was being sued for saying that the painting "La Belle Ferronniere" was not an original Leonardo da Vinci, he required the evidence of an expert who had done some secret work for the Louvre. To obtain it, permission of the Louvre authorities had to be secured. Through a telephone call to Paris the situation was explained and the expert was permitted to testify.

"Personal" Messages

As far as can be judged from the newspaper reports that have been examined, there has been an almost equal ratio between conversations dealing with business or professional matters and those of a personal nature ever since transatlantic telephone service was inaugurated.

This is not surprising, for the urge to communicate with family or friends is especially strong when an ocean separates, and for convenience, reassurance and personal satisfaction there is no substitute for a telephone conversation. This is particularly the case in the holiday season, as the data for Christmas, 1931, show.

For the fifth year in succession, Christmas Day overseas traffic set a new record. A total of 342 messages, echoing Yuletide wishes, sped to or were received from Europe, Australia, South America, island groups in the Atlantic and Pacific, and ships at sea. This compares with a total of 207 messages for Christmas Day, 1930.

The conversations were as follows: Transatlantic, 182 (including five with Australia); South America, 51; Hawaii, 87; Bermuda, 20; ship-to-shore, 2.

There can be no doubt of the political, economic and social significance of an agency of intimate, personal communication between the old world and the new, between the two Americas, and with far away islands in tropic seas ready to answer a telephone call. Five years of overseas service have already indicated how the nations it serves are certain to rely on it, to an ever increasing extent; for the ability to transmit speech and the desire engendered by the flow of goods and people from one nation to another, act and react upon each other. Prophesy must pause in contemplation of the traffic of thought, the freight of ideas, that will cross the telephone bridge in the coming years. But no prophet is needed for those who have themselves thrilled to the magic of a telephone talk to a distant

land, who have heard the answer to an eager question come back with the speed of light over thousands of miles of land and water. One illustration will suffice. It is the story of a Scandinavian in America who was moved to call by telephone his aged mother in Sweden. It was thirty years since he had left his Northland home to journey to America. His mother's parting "Good bye" were the last words he ever expected to hear her speak.

One day he heard of this wonderful telephone service which would enable him to talk all the way back to his boyhood home. He inquired about the charges and was astonished to learn they were well within reach of his pocket book. He promptly filed a call to Stockholm.

His call went through. Breathless with anticipation he waited for his mother's first words. When the trembling, well remembered voice answered across the 4500 miles circuit, his emotions overcame him. He shook with sobs, and for a few seconds was unable to control his voice sufficiently to speak. Quickly mastering himself, however, he went on with the conversation which meant so much to him that two days later he made a trip to the long distance office in New York City just to express his gratitude.

Occasionally those speaking over the overseas telephone channel are aware of a faint noise in the background of the conversation. Sometimes it is static. At other times—who knows?—it may be heart throbs.

K. T. Rood

Some Unusual Conduit Tunnels

IN the course of constructing the underground conduit systems which link together the various telephone communities of the country, it is necessary on occasion to resort to unusual measures in surmounting the natural and man-made obstacles that lie along the selected routes. Most commonly, the problem presents itself in the form of a river or railroad intersecting the line of the proposed conduit and over which there is no structure available for carrying the ducts. Several such undertakings have been completed in the past year or two, perhaps the most interesting of which, from its size, is the crossing constructed under the Harlem River in New York City.

As the usual means of crossing bodies of water in the past has been by submarine cables, it will perhaps be of some value before describing the construction of the Harlem River crossing to consider some of the limitations of the submarine cable.

In routes involving a relatively small number of cables, the steel-armored submarine cable serves adequately in effecting crossings of rivers, bays and similar water barriers. Many of these crossings are of such length that the economic advantages of the submarine cable in this respect favor its selection to the exclusion of any other plan. Ordinarily the cables are simply laid on the bottom. However, where there is likelihood of subsequent dredging operations, the cables may be given additional protection by depositing them in a trench prepared for this purpose. Usually no attempt is made to backfill the trench, this operation being left to the washing action of the water.

However, as the cables increase both in number and importance, the urgency of ensuring against all chance of service interruptions assumes added significance. Particularly is this

true where the river traffic is heavy and the depth of channel is restricted. Such streams demand constant attention in order to keep the channel open. This requires the frequent services of dredges which, if they are for one moment handled incautiously when in the proximity of the submarine crossing, can inflict serious damage with their big dippers.

A further disadvantage of the submarine cable when installed in large groups is the difficulty of maintenance in the event of injury. Generally the cables are buried in mud and often become so entangled by the shifting currents that it would be next to impossible to isolate the ailing cable in order to make repairs. Such efforts, if successful, might take days, during which time the pairs included within the sheath, possibly among them important toll circuits, would be out of service.

The conduit of which the Harlem River crossing forms an essential part carries the main toll circuits from New York City to New England as well as a number of trunk circuits tying together various exchanges in the vicinity of New York. Consequently, security in the greatest practicable degree was the feature which demanded first consideration in the design of this crossing. Next in importance was the provision of sufficient flexibility to permit the ready replacement of any cable which might develop conductor trouble as the result of breakdowns within the sheath. With these salient points in mind the best solution seemed to lie in the construction of a tunnel in which ducts to accommodate the crossing cables could be installed.

To accomplish this, a trench was first dredged across the river bottom at a depth such that the topmost part of the structure would be 27 feet below the mean low water level of the river. This is two feet greater than the maximum depth required by the government regulations controlling the Harlem River. At this depth the conduit structure is safe from any possible injury during dredging operations. The trench-

ing being completed, the balance of the work consisted in constructing a 614 foot pipe tunnel heavy enough and strong enough so that once the ducts were placed inside they would be protected from dragging anchors or similar hazards.

Timber piles were driven and capped to form supports spaced at 12 foot intervals along the trench. While this work was in progress, 12 foot lengths of 84 inch bell and spigot cast iron pipe, each weighing 10 tons, were being assembled and jointed on barges near the shore to form sections 72 feet long. This pipe of 7 foot inside diameter has a wall thickness of 1¾ inches and is reputed, incidentlly, to be the largest cast iron pipe of its class ever produced. A strongback in the form of a riveted steel truss was lowered to the top of a 72 foot section and bound to it with the aid of curved wooden saddles and wire rope cables. A floating derrick was used to pick up the entire unit and lower it into place upon curved cast iron saddles spiked to the cap of every alternate support. After directing the junction of each successive section, divers released the strongback and completed the calking of the leaded joints between sections.

At a point roughly 75 feet out from each of the terminating manholes the pipe began to slope upward toward the manholes at the rate of 4.29 feet in 10 feet. To accomplish this change in grade four curved segments were prejoined by means of lugs and coupling rods and so braced from within that the complete unit could be handled much in the manner of the straight sections. This curve was designed to provide a radius consistent with that obtainable with the standard clay conduit normally used in constructing bends in conduit lines.

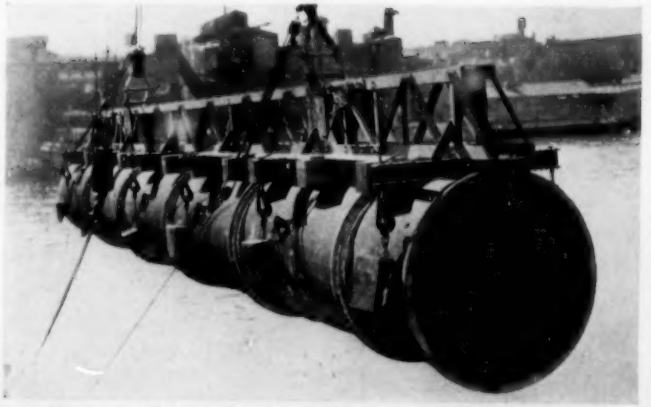
At intervals along the top of the pipe were placed precast saddles of concrete curved to fit the contour of the pipe. These saddles served to add stability and weight against the current of the river, but were intended primarily to act as bulkheads against which side forms for the pouring of concrete could be placed. The space between the forms was filled with concrete

deposited through a tube under water to provide a thickness of 18 inches on the sides and 24 inches at both the top and bottom of the pipe.

After the pipe was pumped dry the tunnel underwent a period of inspection to check for settlement and possible development of leaks. Following this the conduit crews entered the pipe, constructed a narrow gauge track for the movement of materials and began the work of installing the multiple vitrified clay and wrought iron pipe conduits. The headroom in the tunnel was such that 3 foot lengths of clay conduit could be used in place of the 12 and 18 inch lengths usually employed in constructing crossings having a smaller diameter pipe.

An undertaking of this nature being, of course, somewhat of a departure from the usual telephone construction, the normal procedure governing the decision as to the number of ducts to be installed as related to growth was subject to modification. Economic and practical limitations warranted a period of planning greatly in excess of that usually considered proper for the ordinary types of underground construction. This resulted in the installation of ducts sufficient to completely fill the pipe—206 ducts in all. In consideration of the depth at which the ducts are submerged in the river bed and under the protection of 1¾ inches of cast iron and from 18 to 24 inches of solid concrete, it is felt that these cables will be free from the hazards that ordinarily beset the submarine crossing.

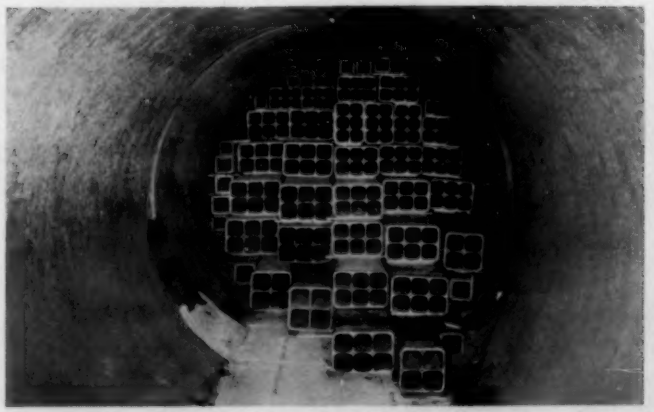
In addition to waterways, conduit routes sometimes intersect man-made barriers that are almost as formidable as rivers, and which are best negotiated by tunneling operations. Contrasted with the water crossing and the handicaps invariably attendant upon marine construction, crossing under a railroad would appear such a commonplace undertaking as to be of but passing interest. On the contrary, however, the plan adopted in the recent construction of a crossing of this type developed into a project of more than ordinary interest as an innovation in telephone construction.



1. Close-up of Pipe—Method of Supporting Prejoined Sections for Harlem River Crossing.

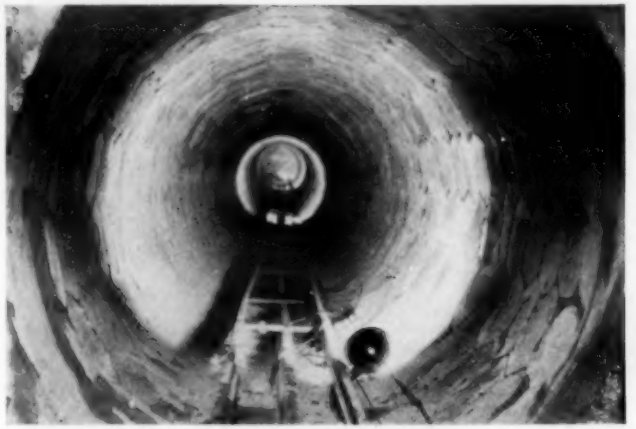
2. Lowering 72-foot Prejoined Section.

3. Curved Section used at Shore Approach.

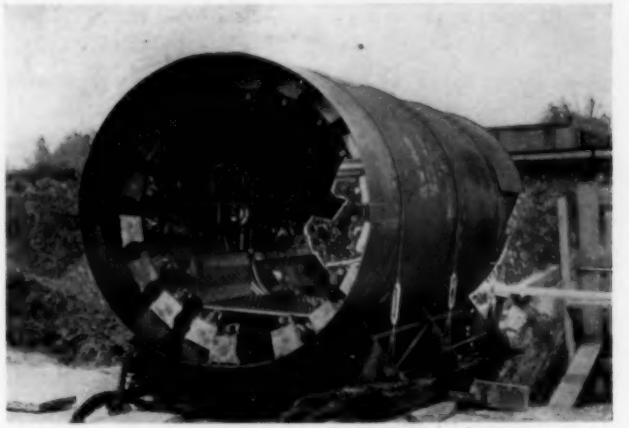


4. Duct Arrangement in 7-foot Pipe.

5. General View of Line of Tunnel under Railroad.



6. Interior View of Tunnel.



7. Rear View of Shield Showing Position of Jacks and Operating Mechanism.

Construction under railroads, while not involving all the difficulties presented by navigable streams nevertheless offers opportunities for the exercise of considerable ingenuity in making the job safer for the workman and more secure against untoward developments. Rights-of-way of narrow width may sometimes be traversed by means of jacking operations whereby individual pipe ducts are driven under the tracks without disturbing the track structure. Where greater width is involved, the uncertainty of control over the direction the pipe may take in passing through the soil precludes the use of the jacking method to any great extent. Obviously, to employ this method of jacking individual pipes would be impracticable where a large number of ducts is required for the crossing.

A variation of the above operation is seen in the method of jacking sections of larger diameter pipe and thereafter installing conduit to complete the crossing. This plan has been employed with considerable success in the construction of culverts and tunnels for mains under embankments. Since a workman is stationed at the front of the pipe to excavate the earth, it is possible with this method to exercise some control over the direction the pipe is taking, and thus much greater accuracy is obtained than when jacking small bore pipe. Without intermediate openings, however, this scheme is apparently impracticable for lengths much over 100 feet or for diameters over 42 inches. The enormous pressures required to overcome the additional earth friction encountered beyond these limits is more than the relatively thin pipe walls will stand without collapsing.

In view of the foregoing, until recently the recourse followed in carrying large numbers of ducts across wide rights-of-way has been by means of an open cut under the tracks. The cost of such work is high, involving as it does much heavy shoring, difficulty of disposing of spoil and the possible need of subsequent operations to correct for settlement. In addition, it is necessary for the railroad companies to reduce the speed of

trains crossing the site and to keep watchmen continuously on duty during the operations.

Tunneling shields for the construction of subterranean passages are not new but with the development of a small bore device to be operated by an ordinary portable compressor came the first opportunity for the use of a tunneling shield in telephone work. Such a device was used in carrying 60 ducts of a conduit system under 15 tracks of a Reading Railroad yard in Philadelphia. This tunnel is 230 feet long and 4 feet inside diameter and is lined with hexagonal faced interlocking blocks of concrete 5 inches thick.

The shield employed in constructing the tunnel is cylindrical, 10 feet 5½ inches long and 4 feet 10 inches outside diameter. It is constructed of cast steel ¾ inch thick except for the tail, 14 inches long and ⅛ inch thick, in which the block lining of the tunnel is built up. Around the inside circumference of the shield is a series of 18 hydraulic jacks actuated indirectly by air pressure from a compressor above ground.

Eighteen blocks compose one complete ring of lining but because of their hexagonal shape nine alternate segments are always half a block ahead of the other nine. In operation one bank of nine jacks bears against these alternate blocks while the remaining nine jacks are retracted. In the spaces thus left are placed nine more blocks. As each block is placed one of the retracted jacks is brought to bear against it, holding it firmly in place. When all blocks in this ring have been set the high pressure oil is turned into the jacks and their action shoves the shield ahead half the width of a block or 4 inches.

As the jacking operation continues, earth is excavated at the front of the shield and is transferred to a conveyor belt. From the conveyor belt it falls into a car on narrow gauge tracks which carries it out to the opening of the tunnel. The same car is used to bring in another supply of blocks on its return trip. Getting the car out to the portal, dumping it and getting it back to the conveyor is the limiting factor in the construc-

tion, for the operation of the shield is practically continuous. Except when waiting for the car, the only time the shield stops moving is during the short interval when the blocks are being placed in the lining ring.

The tunnel is started by excavating a pit to the depth required by the proposed grade. The shield is lowered into place on a steel cradle resting on a concrete mat, the cradle being carefully set to line and grade. The first ring of blocks or starting ring is precast and set in place inside the tail of the machine. The jacking then progresses as described above. When the objective is reached the shield is excavated and the lining wall is completed with a ring similar to the starting ring. Conduit is then placed inside the tunnel to complete the crossing.

The advantages of this method of crossing a railroad are immediately apparent. Four of the tracks under which the tunnel passed are main line tracks over which express traffic is quite heavy, yet there was no break in schedules. Watchmen were not needed, for the men in the shield worked in perfect safety. Since the lining is erected within the tail of the shield where the skin thickness is but ⅛ inch, there is negligible loss of ground as the shield passes and no settlement of ground surfaces or structures. Furthermore, and this is by no means the least of the attractive features of this method, the cost was much less than would have been possible under the most favorable circumstances involving an open cut.

STANLEY A. HAVILAND.

Opportunities for Women in the Bell System

FEW people realize the variety of occupations open to women in the telephone business. To be sure, telephone workers are found everywhere throughout the United States. In this country, one person in every hundred families, on the average, is engaged in some branch of the telephone industry. Despite this fact the public generally is still inclined to think of telephone employees as comprising two groups in the main: men who construct the lines and women who operate the switchboards.

An article on "Telephone Man Power" in the BELL TELEPHONE QUARTERLY for April, 1930, has already described some of the varied types of work done by the men and women of the Bell System. It is the purpose of the present article to indicate in rather more detail the opportunities open specifically to women in the telephone industry.

The first woman telephone operator, employed as an "experiment" two and a half years after the invention of the telephone, doubtless did not realize that she was opening a new and important vocational field to women. Within less than ten years after her entry, women had for the most part supplanted the original "boy operators" in practically every central office in the country. By 1890, when the total number of Bell telephone exchanges was slightly over 750 and the number of telephones had increased to 225,000, there were approximately 3000 women employed in what is now known as the Bell System to meet the growing demand for telephone service. Women were no longer an experiment in the industry; they had found a new and interesting occupational niche. The number entering grew larger year by year, until in 1902 the number of

women equalled the number of men employed. Since that time the proportion of women in the Bell System has further increased until at present they comprise about 62 per cent of the total employee group of men and women.

The employment of women in the Bell System has increased at a considerably more rapid rate than the employment of women in the industries of the country as a whole. At present, the Bell System affords work for practically 3 per cent of the total gainfully employed female population, excluding those engaged in agriculture, and domestic and personal service.

Of greater interest than the large number of women employed, however, is the gradual increase in the variety of opportunities afforded them, at present, in practically all lines of Bell System work.

Early Opportunities

There was practically no choice of occupation within the telephone industry for the young woman who entered it fifty years ago. Nor was there a definite "next step" to take when she had mastered the intricacies of the switchboard and was able to meet in a satisfactory manner the demands of the subscribers. In most cases she remained an operator, deriving her chief satisfaction, according to the testimony of many of these pioneers, from the gratitude of the subscribers and a sense of her usefulness to the community. It was not until the beginning of the Twentieth Century, when the present central office organization and the systematic training of operators began to be general, that a perceptible broadening in opportunities for women occurred in the industry.

A summary of the early experiences of a group of 100 of the women who came into the telephone business between 1879 and 1900, shows that 91 began as operators, 4 combined operating with clerical work or bookkeeping, and 5 entered as clerks. Even as late as 1900, when the total number of women employed in the telephone industry in this country was 22,000,

less than 10 per cent of these were to be found outside the operating force. Interesting opportunities for women outside the operator's job were, however, not entirely lacking in the early days of the industry. The gradual widening of the field of service for women which has characterized Bell System employment practices in more recent years was apparent even before the turn of the century.

In the late Eighties a few women were employed for straight clerical or bookkeeping duties wherever the growth of the business made this advisable. There were women cashiers, in 1899, in several Bell companies. At a somewhat later date, women were employed in the accounting department of other companies, and throughout the Bell System women were beginning to be responsible for the employment of operators and the handling of certain phases of commercial work. Despite these encouraging signs of progress, however, it is not until after the turn of the century that a definite and persistent trend toward broader opportunities for women can be observed. This significant increase in the kinds of opportunities for Bell System women doubtless was hastened by the creditable way in which these women pioneers adapted themselves to whatever responsibilities the day's work might include. It was stimulated by the rapid growth of the business itself, and made possible by a progressive management which recognized at a comparatively early date the importance of woman's contribution.

As a result of all these factors, the young woman entering the business today has a wide range of occupations from which to choose. Given the necessary qualifications and training, she has open to her, moreover, a definite line of progress leading eventually into a position of real responsibility, regardless of the avenue or department through which she may enter the business.

Present Opportunities for the Operator

Although women are contributing, today, to practically every phase of Bell System work, the operator's job is the avenue through which the majority enter the industry.

A recent study of the operator's job, its requirements and its future, has brought out some interesting facts. The high degree of tact and skill required of her have remained undiminished during the years that have elapsed since the first woman entered the business, but the outlook for the operator has changed completely. The young woman entering the business, today, not only has a wide variety of operating jobs open to her when she enters, she also has a definite line of progress ahead of her which may eventually take her up to the chief operator's job in the central office, or into something equally interesting, perhaps in another department of the company.

If she becomes a local operator, she may be either an "A" operator who answers the subscriber's signal, or a "B" operator who completes calls received from other offices. Or she may be assigned to special operating duties, such as information operator, sender-monitor operator, intercepting operator, varifying operator, trouble operator, or special service operator in a dial office.

Or perhaps this young woman, upon completion of the required training may become a toll or long distance operator. In the toll office she may be either an "inward" or an "outward" operator. Or she may be assigned to one of the special operating positions, such as information operator, rate and route operator, or ticket distributing operator.

Whether a young woman enters a toll or a local office, she usually has an opportunity to combine several classes of operating, thereby broadening her experience and increasing her chances of finding the work to which she is best adapted. In both toll and local offices there is ample opportunity for advancement, the normal line of progress in a typical central office being as follows: student, junior operator, operator,

supervisor, evening or night chief operator, and chief operator.

In the larger offices there are other steps which the young woman who hopes to become a chief operator some day may take. She may, for example, after acquiring the necessary background as a supervisor, become a central office instructor or an assistant chief operator. Or, after having demonstrated her leadership and interest in personnel matters, she may become personnel assistant to the chief operator with responsibility for recreational activities, health, and the general welfare of the operating force.

Employment and the Dial System

Occasionally one hears the fear expressed that the introduction of dial telephones is seriously threatening the future of the women already engaged in telephone work; also that it will limit the opportunities for women in the years ahead.

Such a view is contrary to the facts. The Bell System's dial conversion program, adopted because of the complexity of the operating conditions which have been brought about by the country's growth and by the public's service demands, is of necessity a long view program, formulated after a multitude of factors have been considered and integrated. This program calls for the introduction of the dial system for handling local calls in less than 1000 of the System's 6000 telephone exchanges, and this will not be accomplished for at least ten years.

Conversions to the dial system require a long period of technical preparation and this makes possible the carefully formulated technique of "personnel engineering" that distinguishes the Bell System as an employer. Thus, the operating forces in the large cities where the change from manual to dial operating is gradually being made, can be employed in the toll offices or in the remaining manual offices, and used to offset the normal turnover, as employees leave the service to marry or for other reasons. In some localities any need for additional operators prior to conversion to the dial system can be met

largely by employing ex-employees and others who desire only temporary work and are taken on with that understanding.

When the program of conversion to the dial system is completed ten years from now, there will actually be more operators with the telephone companies than at present. Some will be employed at the many manual switchboards that will be retained in places where the dial system is not to be installed. Others will operate the toll and long distance boards. Some will be information operators. A large number will always be needed to supplement the dial service by helping persons who have trouble in dialing, by handling calls to nearby points, especially around large cities, and by rendering general assistance to telephone users.

So far as future requirements for operators are concerned, the present viewpoint would indicate that the trend in the number of operators required will equal, if not exceed, the trend in the growth of population.

Opportunities at Private Switchboards

In addition to the varied opportunities in the central offices of the telephone companies, there is an allied field of occupation that is far larger than is generally realized—the operation of private switchboards on the premises of business concerns. Opportunities in this field for trained telephone operators have multiplied at a rapid rate during the past few years, particularly in the larger cities where the communication needs of business are constant and varied. New York City alone has 35,000 of these "private branch exchanges," and it is estimated that in the United States there are about 145,000 young women employed to operate the private switchboards of telephone subscribers. The high degree of technical skill required today and the important nature of the business served by many private switchboards make this work of unusual interest to the young woman who has acquired telephone operating experience.

The Broadening of the Field for Women

There has been much the same gradual broadening of opportunity for women in all other phases of Bell System work that has been observed in connection with central office employment, particularly during the past ten or fifteen years. The growth of the business has opened up additional opportunities in the older types of telephone work. At the same time the increasing scope of telephone activity has opened up new opportunities for women as well as for men.

The Traffic Department

In the Traffic Departments of the telephone companies this broadening of the field for women occurred first in the actual work of giving telephone service. The women who were first made chief operators demonstrated, at an early date, their ability to handle in a satisfactory manner the many complex service and human problems the new position entailed and, thus, paved the way for women to occupy positions of responsibility in this and all other lines of telephone work.

The next broadening of the field for women developed in connection with the employing and training of operators. From the beginning, women were eminently successful in these lines of work, and, today, the young woman who has the necessary experience and training may find in the company's employment department such opportunities as, interviewer, application supervisor, and, eventually, employment supervisor.

In the work of training operators, a woman may become, in turn, instructor, assistant training supervisor, and training supervisor.

Opportunities for women in the Traffic Department developed next in personnel work. Matrons and personnel workers were installed at a fairly early date in many rest rooms to look after the comfort and well-being of the operators. They also gave the necessary supervision to the off-duty activities of the operators which were usually of a social nature.

In more recent years there has come a marked increase in women's responsibility for practically every phase of personnel work. On district, division, and general staffs, women are, at present, supervising the health and nutrition courses and guiding the social and recreational activities of operating and clerical forces. They are also participating widely in the administration of the benefit plan, employee representation, the thrift program, and other important personnel work.

There has been a similar broadening of opportunity for women in the Traffic Department in connection with the planning and supervision of operators' quarters and of company dining service. In this field several women are finding interesting work as assistant to the traffic employment supervisor in connection with the furnishing and decorating of company sitting rooms, and as supervisor of dining service on district and division staffs.

A somewhat newer field for women than any of those previously mentioned is that of traffic engineering. In a few of the Bell telephone companies, women are working as engineering assistants on such matters as force adjustment, trunk order work, and the preparation of tandem trunk estimates. Women are assisting, too, in the preparation of dial equipment traffic orders and the making of special dial traffic studies.

As private branch exchange instructors and supervisors, women are responsible for instructing operators and maintaining helpful relations with private branch exchange subscribers. In some cities a woman is responsible for training and directing those who give the actual supervision to this important feature of telephone service.

The Commercial Department

Progress of women in the Commercial Department of operating companies has been largely from routine clerical and stenographic work, or jobs as cashiers and tellers—which women held at a fairly early date—to such important positions

as chief clerk, office manager, observer, instructor, directory production supervisor, commercial representative and, even, in some cases, commercial manager in charge of an entire office or group of offices.

In such positions as these, women not only have large responsibilities in directing the routine work of the office and handling the usual business transactions, but they are playing an important part in promoting good public relations and customer good will and co-operation. One of the most recent of these positions for women is that of commercial representative which women are filling in several of the telephone companies. In this capacity they are interpreting service matters to the public by telephone and through personal contact. These commercial representatives are opening up a new field of opportunity for women which promises to become increasingly important as time goes on.

The Accounting and Financial Departments

There has been a noticeable increase in openings for women in the Accounting Department of the operating companies during the past decade. A tendency may be observed in many of the companies to appoint women to staff positions of importance when they have demonstrated their aptitude for the tasks to which they were first assigned in the department. Some of the newer positions which women are holding in the Accounting Department are: librarian, secretary-staff assistant, statistical assistant, and results clerk.

Women have been employed over a considerable period of time in Financial Departments of operating companies where the growth in business and the consequent multiplication of jobs of a clerical nature have given employment to increasingly large numbers of women. Here, the paymaster's office, the stock bureau, and the bank records and bond divisions, each has its force of women clerks, stenographers, and supervisors.

In more recent years, women in this department have filled

such responsible positions as assistant paymaster, supervisor of preferred stock accounts, supervisor of Bell Telephone Securities Company Accounts, and assistant to the transfer clerk. In one of the companies, a woman has recently risen to the position of general cashier with responsibility for pay rolls, stock transfers, bank correspondence, cash estimates, and similar important matters.

The Engineering Department

Positions for women in the Engineering Department of operating companies, like those in most other departments, developed first along routine clerical and stenographic lines. In more recent years, however, a few women have found employment as engineering assistants. It is easy to understand why engineering jobs for women have been late in developing, for most of the work to which women would be assigned as engineering assistants requires formal technical training in addition to a telephone background. The interesting beginning that has been made by women in a few of the companies indicates, however, that there is a limited number of opportunities along this line for those who have the required bent and training.

The Plant Department

Women are employed in the Plant Department of all operating companies though, generally, in smaller numbers and less varied tasks than in most of the other departments. Their work here consists, for the most part, of clerical and stenographic duties, though some opportunity exists for promotion to the position of chief clerk in district, division, or general offices.

Perhaps the most interesting job for women in this department is that of repair clerk to whom customers report, by telephone, service troubles requiring the attention of the line and station maintenance forces.

Women are also employed as assignment clerks in this de-

partment, and the efficiency with which this phase of plant work is carried out has an important cost and service bearing on plant engineering, and construction and installation jobs.

Other Positions

This brief description of what women are doing in Bell System operating companies does not include many important jobs which individuals have been able to develop from relatively small beginnings with the encouragement of their supervisors. Such positions are found in several departments and in practically all companies. In some cases women have attained positions which enable them to make their influence felt along personnel lines in all departments of their respective companies. One of these women, for example, is assistant benefit secretary in her company; another is general supervisor of the health course and related activities, while a third has recently been made assistant to the personnel vice president. There is a woman public relations representative in one company, a supervisor of educational activities in another, and the position of office manager is held by women in several cases.

Nor does this summary attempt to point out the importance of the work of women secretaries in the Bell System, or the contribution of women librarians, many of whom are combining important research with the administration of general or departmental libraries.

Women are finding interesting opportunities, also, on company magazine staffs as associate editors, feature writers, and staff artists. In addition, women physicians and nurses are found in most Bell System companies.

Such opportunities as these, while interesting and encouraging, are not generally open to the average young woman entering the business as an operator. For practically all of the openings previously mentioned, however, operating experience is desirable preparation, if not an actual requirement.

The Western Electric Company

In the Western Electric Company which manufactures telephone equipment for the Bell System, the employment of women dates back to the earliest days of the business. A few women entered this new type of factory work soon after its inauguration and were assigned to such relatively simple tasks as winding coils, braiding cords, insulating magnet wire, and inspecting and assembling apparatus. The skill and aptitude of these pioneers soon made a permanent place for women in this branch of the industry. Shortly thereafter, many women were trained in the use of the micrometer, the Wheatstone bridge, and the slide rule, and assigned to operations requiring a higher degree of skill and proficiency.

The growth of the business also created opportunities for large numbers of women along stenographic and clerical lines, and the number thus employed steadily increased.

With the development of the business and the adoption of new machinery, new processes, and improved safety measures, has come the same gradual broadening of opportunity for women in this organization which has been observed in other parts of the Bell System. Some of these women who entered in routine clerical or factory work were, as a result of their increased proficiency and broader knowledge of the job, placed in charge of groups and sections where large numbers of women were employed. Others were fitted into jobs requiring ability along certain definite lines.

In the Western Electric Company there are, at the present time, women chemists who analyze various materials and chemicals used in the manufacture of the company's products; women engaged in important research along various lines; women heads of training departments; women accountants, draftswomen, physicians, nurses, and dietitians. The current trend seems to be toward even greater diversification of opportunities for women in this important unit of the Bell System.

The Bell Telephone Laboratories

In the Bell Telephone Laboratories there is a relatively large number of women engaged in stenographic and general clerical work and in the operation of various office appliances. Women in this organization are also distributed among a wide variety of less traditional occupations. Some are draftswomen; others are members of technical staffs where some are mathematicians and others librarians; while still others are supervisors, shop mechanics, or technical assistants to engineers and scientists.

One woman in this organization, who entered as a stenographer a few years ago, recently qualified as a practicing patent attorney and is now assistant general patent attorney for the company. Another, also entering as a stenographer, is working side by side with one of the company's foremost scientists in the making of studies which are of paramount importance to the industry.

The American Telephone and Telegraph Company

No survey of woman's contribution to Bell System achievements is complete without reference to the work that women are doing in the General Departments of the American Telephone and Telegraph Company at 195 Broadway, New York City. Here women comprise nearly 50 per cent of the total Headquarters group, and their responsibilities range from those of messenger and junior clerk to supervisor of an entire division, secretary or staff assistant to an official, statistician, or engineer.

The department employing the largest number of women at Headquarters is the Operation and Engineering Department with 375 women workers. Next, in the number of women employed, come the Treasury Department with 224, the Development and Research Department with 193, and the Comptroller's Department which has 150 women employees. The Benefit and Medical Department, the General Service, the

Legal and other departments, although smaller afford opportunities equally varied and interesting.

Many of the positions open to women at Headquarters are of a routine clerical and stenographic type, as is the case in any large organization. There is, however, a variety of important supervisory positions held by women in connection with such work which calls for initiative and entails considerable responsibility. Some of the women in those positions are chief clerks and cashiers who supervise large forces of clerical workers, handle payrolls and expense accounting, and direct messenger service. Others supervise stenographic, mail, and file bureaus with large forces to be directed. Still others have charge of the various department records and accounts. One of these women, for example, has complete responsibility for the work of the transcription room in one of the larger departments where her duties include employing and training new employees and supervising a large stenographic force. Other women, as floor clerks, direct the messenger force, handle personal checks and vouchers, arrange for conferences, compile various reports, and supervise the ordering and up-keep of office supplies and equipment.

The personnel and general service requirements of the twelve hundred women employed at Headquarters constitute another field in which women play an important rôle. In her capacity as supervisor of recreation, one woman is responsible for directing the recreational activities, cultural and athletic, of women at Headquarters. Another supervises personnel and administrative matters of the company medical office, where other women, as doctors and nurses, help to look after the general health of employees.

In the Treasury Department of the company, where the regular work requires the employment of a large force of clerical workers, a woman personnel representative is responsible for the employment and counseling of the women workers

in the department and for the compilation of special personnel studies.

Much of the work done by women in certain departments of the American Telephone and Telegraph Company requires special ability and training as, for instance, that done by draftswomen and computers who work out engineering formulas, and that done by women accountants and statisticians. In such capacities as these, the responsibilities carried by women range from those of drafting room clerk to the supervisor of graphics; from individual computer to the supervisor in charge of groups of computers and special studies; and from clerical assistants in the Comptroller's and the Treasury Departments to junior and assistant statisticians.

Equally interesting and highly specialized is the work of the fifty-two women in the Headquarters organization engaged in engineering duties, some of whom have the title of engineer. Some of the women in this group conduct studies for the improvement of operating methods, devise such methods, supervise their trial and judge their worth. Another plans many types of studies of an analytical nature relating to message use and the effect of rate changes on revenues, develops rate schedules to meet specific situations, and prepares studies on rate theory.

In the field of theoretical engineering women are likewise making substantial contributions. One of these is engaged in the analysis of earth currents and their relation to radio transmission. Another solves special problems, individually assigned, or works in collaboration with other engineers on such problems as wave propagation and phase distortion. Both of these women have contributed articles to the Bell System Technical Journal, and one of them holds three patents.

There are many other interesting opportunities for women in this organization, in research, in supervision of special activities such as the health and nutrition courses, and in other special services, many of which are System-wide in their influence, but

the examples previously given will serve to show that, at Headquarters, as in the field, women are participating widely in practically every phase of Bell System work.

This general survey of woman's part in Bell System work illustrates, to some extent, how the horizon of the telephone industry is widening, year by year, and how the field of service open to the woman telephone employee is widening with it.

The importance of the contribution which women have made to the development of the telephone industry can never be truly estimated. Suffice it to say that from the earliest days of the business until the present time, women have played a vital part in making possible an indispensable public service, and in so doing, have found the satisfaction which comes from participation in a worthwhile enterprise.

LAURA M. SMITH

Changes in the Composition of the American Population

IT is obvious that all classes of people are not equally important as present and prospective users of telephone service. For instance, children can be almost entirely eliminated from consideration as telephone subscribers; native whites constitute a better market than negroes or the foreign born, while social and economic differences also have an important bearing upon telephone usage. Thus, the composition and characteristics of the population are of more interest to the telephone industry than mere numbers. Returns of the Federal Census of 1930, when compared with those of the 1920 Census, indicate that during the last decade many significant changes have been taking place in the composition of the population, among which the outstanding features were the general tendency towards decidedly smaller families, the aging of the population, the movement from farms to cities, the restriction of foreign immigration, the improved standards of living, and more widespread education.

Before proceeding to an analysis of the census material now available regarding the composition of the population, it seems pertinent to consider briefly one phase of the recorded increase in numbers during the past ten-year period. (It might be noted at this point that various aspects of the numerical growth in population between 1920 and 1930 have already been discussed in this QUARTERLY, in the issues of October, 1930 and April, 1931.) Between 1920 and 1930, a gain of 17,000,000 was reported for the population of the United States, whereas under the most favorable interpretation of the available vital statistics there was an excess of births over deaths of only 11,000,000 and net immigration, based on official figures,

amounted to only about 2,700,000, with the possibility that this figure might be increased to 3,000,000 if allowance be made for illegal entrants. Thus, at least 3,000,000 of the growth remains unexplained.

The portion of the reported increase in population from 1920 to 1930 which is unaccounted for by either natural increase or immigration can probably be most logically explained by the greater thoroughness of the recent enumeration as compared with the 1920 census. This view was expressed in an earlier discussion of census returns[1] in which the following statement appeared:

"A variety of factors indicate that the 1930 census may have been taken with greater efficiency than those of 1920, 1910, and 1900, all of which were apparently made on about the same basis. . . . Although no definite correction of any excess of the reported decade increase over actual growth can be made until the detailed tables on age, sex, and nativity are available, it is probable that the elimination of the excess would reduce the average annual increase to about the same level as was experienced between 1910 and 1920."

This detailed information is now available and its analysis offers evidence that the increased efficiency of the 1930 census resulted in an excess in the reported population increase over actual growth ranging from at least 2,300,000 up to a possible maximum of 5,400,000, with the most probable figure lying somewhere between 3,000,000 and 4,000,000.

Age statistics, by sex and nativity, indicate important discrepancies between comparable groups in 1920 and 1930. For instance, there were more native white females of native parentage in each five-year age group between 10 and 24 in 1930 than there were in the corresponding groups from 0 to 14 in 1920. Since there could have been no accretions to this class through immigration, this inconsistency implies either a negative death rate or a difference in the degree of efficiency with which the two census counts were taken. This evidence of greater efficiency in 1930 is especially convincing since similar

[1] Bell Telephone Quarterly, October, 1930, page 275.

inconsistencies occur too frequently among both whites and colored, male and female, to be accounted for by misstatements of ages on the part of those enumerated. In fact, when adequate allowance is made for deaths, this type of discrepancy between the 1920 and 1930 enumerations appears in almost every age group in all nativity classes.

No exact mortality rates are available for the entire unselected age groups and classes of population, but if the death rates given in the United States Life Tables for the original registration area of 1910 are applied to the 1920 population, the apparent excess of the recorded population increase over the actual growth during the decade 1920–1930 would amount to about 5,400,000. Even if all the people experienced the same improvement in mortality as did the policyholders of the Metropolitan Life Insurance Company between 1910 and 1925, which seems very unlikely, this figure would be at least 2,300,000. A consideration of all the available evidence indicates that the probable difference between the two census counts, due to the better enumeration in 1930, amounts to about 3,500,000, which may be distributed among the principal nativity groups according to the following rough figures: 2,000,000 to 2,200,000 native whites, 800,000 to 900,000 negroes, and the balance in the foreign born, and colored classes other than negroes.

The assumption of the approximate figure of 3,500,000 as the measure of the superiority of the 1930 enumeration leaves 13,500,000 as the true population growth in the United States between 1920 and 1930, a figure which not only is entirely consistent with the detailed statistical data, but also is in closer accord with the marked decline in the rate of natural increase which has been characteristic of the past decade.

Age Composition

This retardation of the rate of growth, perhaps the most significant recent trend in respect of population, has been due,

in large measure, to a declining birth rate; but it may also have been influenced by the aging of the population. This latter development has tended to offset the effect upon population numbers of the improvement in mortality experience resulting from modern sanitation and advancing medical science.

Comparative age group data for 1930 and 1920 indicate that the average age of the population is increasing and suggest the probability of a further decline in the rate of natural increase as the proportion of the total population now in the age groups favorable to high birth rates and low death rates becomes less and less. This change will not only reduce the overall birth rate in the future, but will also increase the overall death rate; for as the average age advances there will be proportionately more people in the age groups where death rates are high than is now the case.

PERCENTAGE DISTRIBUTION OF POPULATION IN THE UNITED STATES, BY AGE, COLOR, AND NATIVITY, 1930 AND 1920

Age Group	All Classes		Native White		Foreign Born White		Negro	
	1930	1920	1930	1920	1930	1920	1930	1920
Under 5.....	9.3	10.9	10.4	12.7	0.2	0.3	10.3	10.9
5–14.....	20.1	20.9	22.3	23.3	2.0	3.6	22.0	23.9
15–24.....	18.3	17.7	19.4	18.6	7.4	10.7	20.6	20.5
25–34.....	15.4	16.2	15.1	15.2	16.9	22.6	16.3	15.4
35–44.....	14.0	13.4	12.6	11.8	24.9	23.1	13.3	12.7
45–54.....	10.6	9.9	9.3	8.7	21.6	18.0	9.6	9.1
55–64.....	6.8	6.2	6.1	5.5	14.5	11.8	4.6	4.1
65–74.....	3.8	3.3	3.4	2.9	8.8	6.6	2.2	2.2
75 and over...	1.7	1.5	1.4	1.3	3.7	3.3	1.1	1.2
Total....	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

The tendency of the past decade toward lower birth rates has decreased the proportion of children in the total population so rapidly that there were actually 130,000 fewer children under 5 years of age in 1930 than there were 10 years previ-

ously; children in the 0 to 9 age group comprised 19.6 per cent of the total population in 1930, as contrasted with 21.7 per cent in 1920. The reduction in the number of births is further emphasized by the drop in the number of children under 5 years old per 1,000 women aged 15 to 44 from 468 in 1920 to 392 in 1930, or per 1,000 married women from 543 to 438.

While the number of young children is declining, the number of aged people is increasing. There are now more than 6,700,000 persons in the country who have reached or passed the age of 65, and they constitute 5.4 per cent of the population, as contrasted with 4.7 per cent in 1920. These figures suggest why problems connected with old age are becoming more important. Moreover, it appears probable that this tendency toward an increase of older and a decrease of younger persons will become more pronounced with each passing decade. This prospect is regarded by some people as indicating that the rate of growth of the American population will rapidly decline to a very low level.

Racial Composition

The population of the country not only is tending towards stabilization in numbers, but also is becoming more homogeneous in character. The latest census recorded an increase of 14,600,000 native born whites during the decade; while the foreign born whites gained only 100,000, and now constitute 12 per cent of the total white population instead of 14 per cent as in 1920. The percentage of negroes has also declined, from 9.9 per cent to 9.7 per cent.

Although negroes declined in proportion to the total population, they had a recorded numerical increase of over 1,400,000 between 1920 and 1930. Two-thirds of this gain took place in the North, while the South failed even to hold its natural increase, indicating clearly the effect of continued migration of negroes from the South to other parts of the country. In fact, four southern states—Georgia, Kentucky, South Carolina, and

Virginia—showed a net loss in negro population. If, as indicated elsewhere in this article, the actual negro gain in numbers was considerably less than the apparent increase, particularly in southern territory, it is possible that the entire growth took place in northern states.

The foreign born element in the total population is declining in importance from two causes. On the one hand, the immigration laws enacted during the past decade strictly limit the number of aliens to be admitted into the country each year and also, by means of the " national origin " plan of distributing the total quota, favor those countries whose nationals are most readily assimilated into our population. On the other hand, the majority of our alien population migrated to America 20 to 30 years ago, and the aging of this group is causing a rise in its total death rate and, concurrently, is mainly responsible for a decline in the number of births. The 1930 census shows 1,400,000 fewer children under 10 years of age of foreign or mixed parentage than did the 1920 census. It is probable that the 1920–1930 decade will be the last to show a gain in the number of foreign born whites in this country, and that education and intermarriage with the native born will tend to lessen further their importance as a more or less distinctive group in our population.

Educational Composition

There was an increase in school attendance of nearly 5,500,000 during the past decade; and the percentage of children in school rose from 64.3 to 69.9. While this improvement in school attendance was general for children of all ages from 5 to 20 and in each nativity class, being especially marked among the foreign born, it was most pronounced among those attending secondary schools and colleges. The increasing tendency toward higher education is also indicated by the fact that in 1930 more than 1,000,000 persons 21 years and over were seeking advanced training, which was three times the cor-

responding number in 1920. This increased school attendance has undoubtedly contributed appreciably to the improvement in literacy.

The number of illiterates in the population 10 years of age and over in 1930 was nearly 4,300,000, or 4.3 per cent as compared with 6.0 per cent in 1920. The bulk of these illiterates were among the foreign born whites (1,300,000, or 9.9 per cent of their total), negroes (1,500,000, or 16.3 per cent) and other colored races (360,000, or 25 per cent). In the North and West, the percentage of illiteracy was 2.7, and in the South, 8.2. In general, illiteracy was lower in urban territory than in rural, especially among negroes; while in rural areas it was greater in the farm than in the non-farm population.

The total number of illiterates in the United States was 650,000 lower in 1930 than in 1920. During the decade, however, deaths among those who were illiterate in 1920 amounted to about 1,000,000 and the illiterates 10 to 19 years of age were 160,000 less numerous in 1930 than in 1920, resulting in a total shrinkage from these causes which was over 500,000 greater than the overall reduction reflected by the census. Moreover, these figures take no account of the improvement in literacy which must have occurred in view of the more general education of all classes during the past decade; on the contrary, they even seem to indicate that a considerable number of people forgot how to read and write between 1920 and 1930. Such an interpretation is, of course, unreasonable. It is more likely that the discrepancy of 500,000 is additional evidence of the greater efficiency of the 1930 enumeration and that the 1920 count would have shown a correspondingly greater number of illiterates had it been taken with the same degree of completeness as that of 1930. This presumption derives additional support from the report of the U. S. Bureau of Education showing that considerable progress has been made in industrial and commercial training and that increased attention has been devoted to adult education.

Further indication of a better count in 1930 is found in the fact that, although every state in the Union showed less illiteracy in 1930 than in 1920, certain areas within states appeared to increase in illiteracy. There were more than 500 counties, or 17 per cent of the total number, in which the reported percentage of illiteracy seemed to have gained; and over 300 counties in which the reported proportion of illiterate negroes was higher in 1930 than at the time of the previous census. Since in most of these counties the total population growth was insufficient to indicate any inward migration and since the proportion of illiterates would normally have been reduced through the effect of literate children passing their tenth birthday combined with deaths among the adult illiterates, it is most probable that many of these counties which apparently lost ground in their degree of literacy actually represent areas where the efficiency of the recent census was particularly effective. Supplementary evidence from other sources indicates that the superiority of the 1930 enumeration was most marked in southern rural territory and in the larger northern cities.

Rural and Urban Composition

Probably no factors have a more pronounced influence upon the characteristics and rate of growth of the population than do those arising out of the comparative degree of rural and urban living. In general, country life is much more favorable to a high rate of natural increase than is residence in cities. On the one hand, rural birth rates are higher. According to the 1930 census, the number of children under 5 years old per 1,000 married women in the United States was 370 in urban territory and 530 in rural areas (both these ratios are lower than the corresponding figures in 1920 by 100); furthermore, the rural ratio, when sub-divided, shows 492 for the rural non-farm and 565 for the farm population. On the other hand, life tables giving rates of survivorship by sexes among the

urban and rural population show decidedly lower mortality rates in the country than in the cities.

The past ten years have been characterized by a great increase in the proportion of the population living in the cities. Numerically, the urban dwellers increased by 14,600,000 and now form 56 per cent of the total population, while the rural population gained 2,400,000. Although the farm population of the country decreased by 1,200,000, or nearly 4 per cent, in the last decade, the number of non-farm rural dwellers increased by 3,600,000, or 18 per cent. This latter number evidently includes not only the growing body of city workers who prefer to reside in the country, but also many farm laborers who want the advantages of more desirable living conditions in nearby small towns.

Of the 8,500,000 persons reported as "gainfully employed" in 1930 who reside in non-farm rural territory, about 2,500,000 are engaged in manufacturing and mechanical industries, primarily urban occupations, while 900,000 are connected with agriculture. On the other hand, 1,500,000 of the 10,600,000 workers living on farms are engaged in activities other than agriculture. The phenomenon of several million workers living in rural territory some distance from their regular occupations (in addition there are 450,000 engaged in agriculture who reside in urban communities) emphasizes the influence of the automobile and good roads in facilitating travel and in making possible the greater mobility and flexibility in the distribution of population.

In general, the migration from farms to cities has been due in part to reduced labor requirements in agriculture and in part to the opportunities for improved economic status. This type of movement now constitutes the principal portion of all internal migration and it may be expected to continue in appreciable volume as agricultural efficiency improves further and foreign immigration remains at a low level.

Occupational Composition

The occupational make-up of the population very markedly affects the number of children born, as birth rates vary greatly between different occupations. Farmers and miners have larger families than workers engaged in sedentary activities, while between these extremes are the handworkers in industry and commerce. In general, it may be stated that the wives of manual laborers have more children than do those of the white collar workers and that economic success appears to be unfavorable to the raising of large or even fair-sized families. In view of these basic conditions, the census returns show certain changes during the decade in the increase and distribution of workers by industries which appear strikingly significant.

The 1930 census showed a total of nearly 49,000,000 persons over 10 years old who are normally gainfully employed, as compared with less than 42,000,000 in 1920. A complete breakdown of all these workers into groups comparable with 1920 data is not possible at present, since the available classification is by industry groups rather than according to occupations. However, comparable figures are available for the largest two industrial groups; they show that the number of workers in each group declined between 1920 and 1930: in agriculture by nearly 500,000, or 4.3 per cent, and in manufacturing by about 200,000, or 2.1 per cent. A greatly increased efficiency in farming operations has been effected by the wide introduction of more scientific farm practices and the widespread use of motor-driven machinery, with the result that fewer workers have been able to produce all the required supply of agricultural commodities. Similarly, a reduction in the number of wage earners engaged in manufacturing has resulted from technological improvements in industry. And, as further developments are realized in labor-saving appliances, there will doubtless be additional declines in the number of workers required in these broad fields.

The greater productivity of machine labor has brought about an increase in wages and a higher standard of living. The general improvement in living conditions is reflected in the much larger number of workers engaged in the service industries. Women workers in particular in these activities have gained in number; over 3,000,000 of them are employed in domestic and personal service, while nearly 1,800,000 are engaged in activities classified as professional service, exceeding the number of men in the professional classes by 100,000. In fact, the increased importance of women in industry in general is worthy of special attention.

Among the 49,000,000 gainfully occupied workers enumerated in the 1930 census, nearly 11,000,000 were women. This number represents an increase of 2,200,000, or 26 per cent, over the previous census, whereas male workers increased by only 15 per cent. The significance of these figures becomes apparent when it is noted that the increase in women workers during the preceding decade from 1910 to 1920, when women took the places of many thousands of men withdrawn from industry, was only 6 per cent, as compared with 10 per cent for males. Thus, female workers not only increased between 1920 and 1930 more rapidly than during any like period, but they increased more rapidly than male workers. This is significant as indicating the status women are assuming in our occupational life.

The decline since 1920 in the actual percentage of males 10 years old and over who were reported as gainfully occupied is due only in very small part to a change in the age composition of the working population. In fact, it can be almost entirely explained by the increased school attendance and by more general and earlier retirement from active work.

Size of Family

The combined and cumulative effect of the several foregoing changes in the composition of the population tending to reduce

the rate of natural increase has been reflected to a marked degree in the average size of family and consequently in the number of families. There were nearly 30,000,000 families in the United States on April 1, 1930, an increase since the 1920 census of about 5,600,000, or 23 per cent. Thus, the number of families grew more rapidly than the population, due to the decline in average size of the individual family from 4.341 persons in 1920 to 4.095 in 1930, the equivalent of about one-quarter of a person per family.

Among other things, the family figures indicate a return during the decade to living conditions more normal than those of the beginning of 1920. Since that date, there has been an appreciable increase in families, and a consequent reduction in the average size, through the spreading out into separate living quarters of families who had been forced to double up with others during the housing shortage prevalent in the early part of the decade. The building boom of the mid-decade years relieved that congestion and permitted a distribution of families to normal living accommodations (a condition existing at the date of the census in April, 1930).

More important factors in causing the decline in the size of family, however, have been the rapid urbanization of the population, which has brought a large part of the people into the cities, and the curtailment in the average number of children per family, which is one of the most striking tendencies in American life. As the standard of living has been raised, there has been the apparently axiomatic decrease in the size of the family. When it is noted that the number of adults per family only dropped from 2.57 in 1920 to 2.51 in 1930, while the number of children per family declined from 1.77 to 1.59 during this period, it is evident that the reduction in birth rates was largely responsible for the smaller sized family.

Conclusion

From a market standpoint, the most significant conclusion to be drawn from a study of the recent changes in the composition of the American population and the current trends of growth is that, in the future, the number of consumers will increase with considerably less rapidity than in the past. At the same time, the characteristics and the requirements of the consuming market will change, for, due to the lower birth rate, the relative number of young people is decreasing and that of old people is increasing. In short, in view of the influence of such tendencies as those discussed above, it is indisputable that the characteristics of the American consuming market is in process of profound modification in many directions.

R. L. Tomblen

Eighth Plenary Meeting of the International Advisory Committee on Long Distance Telephony

THE year 1931 has probably seen the establishment of an unprecedentedly large number of new "lows" in the field of industrial activity. All the more interest therefore attaches to the fact that during this period the telephone business of Europe has grown in certain respects. This is particularly true of Anglo-European toll business. The following table compares the toll calls between England and France and England and Germany for the first three-quarters of 1931 with the corresponding intervals for 1930. The values for 1930 were greater in turn than those for 1929.

	Anglo-French Paid Minutes	*Anglo-German Paid Minutes*
1930		
1st Quarter	590562	343089
2d "	625883	330709
3d "	552192	321919
1931		
1st Quarter	625722	329769
2d "	667709	345657
3d "	672820	393313

Such figures indicate very clearly the increased popularity of international telephony in Europe and this growth in popularity is, of course, in large measure the result of a steadily improving service.

The work of the International Advisory Committee (the C. C. I.) has greatly facilitated the realisation of these improvements. As was explained in an earlier article this international organisation, comprised of technical and operating experts from well-nigh all of the telephone administrations of Europe together with a good representation from the New

World, has been entrusted with the study of important telephone problems and the recommendation of improved methods for coping with them. Although these recommendations are in no sense binding on the participating administrations, they are quite generally adopted and the rapid strides that international telephony has made in Europe in recent years are in no small measure due to the efficient work of the C. C. I.

Once each year the studies of the various sections of the C. C. I. are submitted to review at a Plenary Assembly. During this review studies are either formulated into definite practices and officially recommended or else returned to the various Committees for further consideration. New questions are also proposed and adopted for study.

The Eighth Plenary Meeting of the C. C. I. was held in Paris between the dates of September 14th and September 21st, 1931, inclusive.

In accordance with custom the Presiding Officer was chosen from among the officials of the Administration acting as host. In this instance M. Lange, Directeur Generale de l'Exploitation Telephonique of France was unanimously selected.

The Vice-Presidents elected to deal respectively with questions of Protection, Transmission, Traffic and Commercial were:

Dr. Breisig .....Germany
Mr. Muri .....Switzerland
Sir Thomas Purves .....Great Britain

Of the 36 Administrations or National operating groups adhering to the C. C. I. 24 were represented at the Eighth Plenary Assembly, and in addition there were present representatives of the International Telegraph Union of Berne and delegates from various electro-technical groups such as the Union Internationale des Chemins de Fer, Union Internationale des Producteurs et Distributeurs d'Energie Electrique, Union Internationale de Radiodiffusion, etc.

Matters of General Organisation

During the past year there has been a considerable increase in the membership of the C. C. I. This includes two new operating Companies in the Argentine (which is already represented by five separate Companies) the Telephone Administration of the Dutch East Indies, the Chile Telephone Company, the Telephone Administration of the Union of South Africa, the Republic of Uruguay (represented by two Companies) and Roumania (represented by the Societatea Anonima Romana de Telefoane). It is understood that an agreement has been reached among the seven Argentine Companies as to the proportional share of the payments to be made by each toward the Budget of the C. C. I. and that an alternate plan has been worked out to provide for the appointment of a Chef de Delegation to represent the group at the various C. C. I. Meetings.

The Budget

During the Paris meetings the Plenary Assembly examined the suggestion made by one of the Administrations that the basis of apportioning the expenses of the C. C. I. would be more equitable if based upon population rather than upon the schedule used by the International Telegraph Bureau of Berne. This suggestion was discussed at the Plenary Assembly and there developed a considerable difference of opinion, and finally, it was decided to leave the matter to the choice of each Administration; that is, each may elect to make its contribution either on the basis of the Berne Bureau schedule or on a classification based upon population, such choice to be made prior to the issue of the call for funds, so that the necessary notices can be promptly sent out.

At this point a word might be said regarding the operating expenses of the C. C. I.

During the past year about $23,600 was expended while the budget for 1932 indicates a slight reduction to about $23,200. In view of the important character of the work which the C. C.

I. is accomplishing these figures seem very moderate It is, furthermore, anticipated that from now on, with co-operation between the various telephone Administrations firmly established, the operating costs of the C. C. I. will tend to diminish. A feature tending to offset the diminishing costs due to the greater efficiency of the machine as a whole is the increasing amount of work placed on the separate committees due to the ever-growing number of questions requiring to be studied. It was with the idea of reducing the amount of work required to be studied in Committee meetings that the delegation from the American Telephone and Telegraph Company suggested at the Paris Plenary Assembly a method whereby it is expected that the work entrusted to the various Commissions will be simplified.

Questions Studied by the C. C. I.

The proposal is to divide the questions undertaken by each of the Committees into two distinct categories, A and B:

"A" questions regarding which it is important to have international agreement and uniformity of practice, either within the Continent of Europe or for the world as a whole.

"B" questions primarily of an informative character concerning which the distribution of information by the C. C. I. is helpful in assisting telephone development, but concerning which it is not vital that there should be uniformity of practice among the different nations. In the case of some of these questions, uniformity of practice would not be practicable because the desirable arrangements depend largely upon local conditions.

The above proposal was examined by the Chief Delegates and approved by them and by the Plenary Assembly.

Under the proposed arrangement, questions of Class "B" will be handled more informally, perhaps entirely by correspondence, thereby reducing the amount of work to be handled at the actual Committee meetings.

To take up in detail in the present article any of the questions now under study by the various Commissions of the C. C. I. would lead to many ramifications. In general, these questions cover broadly the subjects of Protection, Transmission, and Traffic and Commercial. Under the heading of Protection there were about a dozen questions reported on at Paris; under Transmission and its component elements there were nearly 40 questions, and under Operation, somewhat more than a dozen. Some of these questions deal, of course, with the international transmission of broadcasting programs. The transmission of such programs across national boundaries is becoming more and more popular, and one cannot help but hope that these glimpses of the life of other countries will bear useful fruit, particularly in cementing the friendship of nation for nation.

In connection with the general question of telephone transmission, it is interesting to note that the English and European technicians working from premises largely independent of our work have arrived at similar conclusions to ourselves in regard to the importance of considering all of the factors which influence the ability of subscribers to carry on a telephone conversation. In other words, the importance of effective transmission is fully realised by the C. C. I. and a study of all of the important elements of this problem is included in the list of questions before the various Technical Committees.

Date of Next C. C. I. Meeting

Up to the present the Plenary Assembly Meetings of the C. C. I. have been held each year, but this is not specified in the regulations, and the time and place of future meetings is arranged by the Chief Delegates in consultation with the General Secretary. An exchange of views on this matter took place at the Paris Meeting.

Following an invitation extended by Mr. Hernandez Barroso of Spain, it was agreed that the next Plenary Meeting

which, however, would deal only with questions of traffic and commercial matters, should be held at Madrid during September, 1932, and that this meeting should be preceded by a meeting of the Rapporteurs of the Sixth and Seventh Commissions. No decision was made in regard to the date or meeting place of the Technical Commissions C. Rs One to Five inclusive, an agreement in regard to which will be arrived at at a later date by the Chief Rapporteurs of the various Commissions in consultation with the General Secretary. It is probable that these meetings will be held simultaneously during the year 1932 at some point in Europe convenient to the various Administrations directly interested.

H. E. SHREEVE

Notes on Recent Occurrences

NEW TELETYPEWRITER SERVICE

A COMMUNICATION service which offers the flexibility of telephone service in the transmission of the written word was made available November 21, when the Bell System announced the inauguration of teletypewriter switching service.

The teletypewriter transmits typewritten messages electrically over wires, so that whatever is typed at one end of a circuit appears, practically at the same instant, at the distant end, also in typewritten form. Teletypewriters have been in extensive use for some years in connection with private wire service contracted for by large business concerns having branch offices, banks, brokers, press associations, police departments, air transport lines and others.

In order to provide the new service, teletypewriter exchanges are being established at various points throughout the country so that a subscriber to the service may transmit written messages directly to any other subscriber, anywhere, at any time. This new service is a "two-way" service, permitting inquiry and reply to be made immediately on the same connection.

OVERSEAS TELEPHONE SERVICE FURTHER EXTENDED

Roumania

ON November 9 transatlantic telephone service was extended to include all of Roumania. The service was inaugurated by conversations between officials of the State Department and ministers of the Roumanian government. It embraces all Bell and Bell-connecting telephones in the United States, Canada, Mexico and Cuba. Conversations are handled

over the radio channels between New York and London now connecting North America with practically all of Western Europe. The charge for a three-minute conversation between New York and any point in Roumania is $39 with $13 for each additional minute. Roumania has some 50,000 telephones, operated by the Societatea Anonima Romana de Telefoane, a subsidiary of the International Telephone and Telegraph Corporation. About a fourth of these are in Bucharest, which is partly served by automatic exchanges. The country, whose principal industries are agriculture and stock-raising, has a population of about 17,700,000.

Sumatra

On November 12 telephone service was opened to the island of Sumatra in the Dutch East Indies. The circuit to Sumatra, like that to Java to which service was opened last April, is in operation during the business day. The charge for a call between New York and any point in Sumatra is $49.50 for the first three minutes and $16.50 for each additional minute. Three radio circuits, linked by wires, are required to establish the telephone connection between the United States and Sumatra. Calls to the island travel over the regular transatlantic radio telephone circuits to London, thence by wire to Amsterdam and from there by radio to Bandoeng in Java. Another short wave radio telephone circuit links Bandoeng with Medan in Sumatra. The service connects all telephones of the island with the United States, Canada, Cuba and Mexico.

Brazil

The Bell System's radio telephone service to Rio de Janeiro, Brazil, was opened on December 18. Brazil is the fourth South American nation to be brought within reach of United States telephones, service to Argentina, Chile and Uruguay having been in operation since April, 1930.

The Brazilian service is available to all Bell and Bell-connecting telephones in the United States, Canada, Cuba and Mexico. At the southern end it embraces all telephones in the states of Sao Paulo and Rio de Janeiro, and in the southeastern part of Menas Geraes. The Brazilian network involved in this new extension has some 104,000 telephones serving a population estimated at 9,500,000.

The connection to Brazil is established over a short wave radio telephone channel 4,800 miles long between the transoceanic stations of the American Telephone and Telegraph Company at Lawrenceville and Netcong, N. J., and stations operated by the International Telephone and Telegraph Corporation near Rio de Janeiro. These stations connect with the lines of the Brazilian Telephone Company.

The cost of a call between New York and Rio de Janeiro is $30 for the first three minutes and $10 for each additional minute.

Bermuda

Telephone service by radio to Bermuda was opened on December 21. The service is available to all Bell System and Bell-connecting telephones in the United States, Canada, Cuba and Mexico.

The channel is operated on short wave, using wave lengths in the vicinity of 30 and 60 meters. It is in service daily from 9 a.m. to 9 p.m., New York time. The cost of a call between New York and Bermuda is $15 for the first three minutes and $5 for each additional minute.

Hawaii

Hawaii and the North American mainland were linked by regular telephone service on December 23, marking the first step in the extension of Bell System overseas telephone service

to the Far East. The new service interconnects all Bell and Bell-connecting telephones in the United States, Canada, Cuba and Mexico with those in the principal islands of the archipelago.

The voice path across the Pacific is over a short wave radio channel between stations near San Francisco and on the island of Oahu. It is in operation during the greater part of the business day.

Through the headquarters of the Mutual Telephone Company of Hawaii in Honolulu the service embraces all telephones in that company, those on other islands being linked by an inter-island short wave radio system.

The cost of a call between San Francisco and Honolulu is $21 for the first three minutes and $7 for each additional minute. Calls involving other points are subject to additional charges proportional to the distance. The charge for a New-York-Honolulu conversation is $30 and $10.

The extension of service to Hawaii recalls the fact that sixteen years ago a young engineer of the American Telephone and Telegraph Company with an experimental radio receiving set heard the voices of telephone engineers coming through the ether from Arlington, Virginia. During the same tests, listeners on the Eiffel Tower, in Paris, caught a few words and finally a connected sentence, also transmitted from Arlington. These early experiments paved the way to the establishment, in 1927, of regular transatlantic telephone service with Europe.

SHIP–SHORE SERVICE TO S. S. *MONARCH OF BERMUDA*

SHIP–SHORE telephone service was opened to the new S. S. *Monarch of Bermuda* when she left New York on November 28 on her first voyage to Bermuda.

The telephone channel from the United States to the ship is

through the ship-shore radio telephone stations of the American Telephone and Telegraph Company on the New Jersey coast. Through these the passengers are able to reach any Bell System or Bell-connecting telephone in the United States, Canada, Cuba and Mexico. The charges for a call between the ship and points along the Atlantic seaboard is $9 for the first three minutes and $3 for each additional minute.

TRAFFIC EMPLOYMENT AND PERSONNEL RELATIONS CONFERENCE

A BELL System regional Traffic Employment and Personnel Relations Conference was recently held near Chicago. The conference was a joint meeting of the traffic men of the areas included and the personnel representatives of the respective companies; together with some of the personnel men from the operating departments of the American Telephone and Telegraph Company.

Long range fundamentals and current problems of traffic employment and personnel relations were discussed, including a consideration of wage and working conditions matters, handling of force surpluses, stabilization of employment, relation between personnel work and some of the major policies of the business and employee representation. The discussions were principally informal, although a few short papers served as a basis for considering some of the subjects. Similar regional conferences had been held previously near San Francisco and Philadelphia. In all a total of approximately 135 men were in attendance.

EQUIPMENT AND BUILDING CONFERENCE

A BELL System Equipment and Building Conference was held at Virginia Beach, Virginia, November 17 to 20, attended by representatives of the various Associated Companies,

the Bell Telephone Company of Canada, the Long Lines Department of the American Telephone and Telegraph Company, the Western Electric Company, the Bell Telephone Laboratories, and the firm of Voorhees, Gmelin and Walker, architects. There were also present a number of representatives from the General Departments of the American Telephone and Telegraph Company.

Following the opening of the conference by J. B. Rees, Equipment and Building Engineer of the American Telephone and Telegraph Company, who acted as Chairman, and a brief greeting by Vice President Bancroft Gherardi of the same company, the conference was addressed by W. H. Harrison, Plant Engineer, of the American Telephone and Telegraph Company, in a review of operating results and the construction program. Papers were presented on the subjects of Small Exchanges, Dial Conversions, Building Activities and Station Matters, prepared to a large extent by representatives of the Associated Companies.

The purpose of the conference was to discuss those items that seem to require particular attention at this time rather than to cover the whole range of equipment and building activities. Great interest was shown in the papers and especially in the discussions. It was the expressed view of the conference that the importance of a fuller and truer appreciation of the duties and responsibilities of the equipment and building engineers had been deeply impressed upon the members.

TREASURY DEPARTMENT TRAINING CONFERENCES

A SERIES of training conferences of supervisory employees has been conducted in the Treasury Department of the American Telephone and Telegraph Company during the past year. Organization, administration, principles of supervision, training and the general development of employees were in-

cluded in the topics discussed and analyzed under the direction of a conference leader.

Among those participating were eight Assistant Treasurers of Associated Companies, 11 of their supervisory employees and 56 members of the American Telephone and Telegraph Company Treasury Department.

Plans have been made to continue similar conferences this winter.